CLAIMS

What is claimed is:

1. A method of generating a computer-based 3D (three-dimensional) model for a patient's anatomical part comprising:

   defining a 3D template model for the patient's anatomical part;

   receiving a plurality of 2D (two-dimensional) X-ray images of the patient's anatomical part;

   extracting 2D fiducial geometry of the patient's anatomical part from each of said plurality of 2D X-ray images; and

   deforming the 3D template model using the 2D fiducial geometry of the patient's anatomical part so as to minimize an error between contours of the patient's anatomical part and those of the deformed 3D template model.

2. The method of claim 1, wherein defining the 3D template model includes selecting the 3D template model from a set of 3D template models stored in an electronic database.

3. The method of claim 1, wherein receiving the plurality of 2D X-ray images includes receiving said each of the plurality of 2D X-ray images in a digitized form.

4. The method of claim 1, wherein receiving the plurality of 2D X-ray images includes:

   generating the plurality of 2D X-ray images of the patient's anatomical part; and

   digitizing said each of the plurality of 2D X-ray images.

5. The method of claim 1, wherein the patient's anatomical part is a bone.

6. The method of claim 1, wherein extracting 2D fiducial geometry includes detecting surface contours of the patient's anatomical part from said each of the plurality of 2D X-ray images.

7. The method of claim 1, wherein deforming the 3D template model includes:

identifying the 2D fiducial geometry of the patient's anatomical part on the 3D template model therefor;

embedding the 3D template model into a 3D lattice; and

deforming the 3D lattice until a projection error between one of the plurality of 2D X-ray images and a corresponding view of the 3D template model projected thereon is minimized.

8. The method of claim 7, wherein deforming the 3D lattice includes:

computing a plurality of free form deformation (FFD) parameters for the 3D lattice; and

optimizing values for the plurality of FFD parameters so as to minimize the error between the contours of the patient's anatomical part and those of the deformed 3D template model.

9. The method of claim 7, wherein the 3D lattice is constituted of a plurality of parallelpipeds.

10. The method of claim 1, wherein said each of said plurality of 2D X-ray images is contained in a plane that is orthogonal to the planes containing the remainder of said plurality of 2D X-ray images.

11. A computer-based method of generating a surgical plan comprising:

reading digital data associated with a 3D (three-dimensional) model of a first patient's bone, wherein the digital data resides in a memory in a computer; and

generating a first surgical plan for the first patient's bone based on an analysis of the digital data associated with the 3D model.

12. The method of claim 11, wherein generating the first surgical plan includes specifying an osteotomy site on the first patient's bone based on the analysis of the digital data.

13. The method of claim 11, wherein generating the first surgical plan includes:

determining whether a second surgical plan exists for a second patient's bone having bone contours similar to the first patient's bone; and

generating the first surgical plan based on information contained in the second surgical plan.

14. The method of claim 13 wherein determining whether the second surgical plan exists includes accessing a surgical plan database to read past surgical data therefrom.

15. The method of claim 11, wherein generating the first surgical plan includes:

selecting a fixator to be mounted on the first patient's bone; and

determining a location on the first patient's bone where the fixator is to be mounted.

16. The method of claim 15, wherein selecting the fixator includes accessing a database to choose the fixator from a plurality of fixator configurations stored therein.

17. The method of claim 11, wherein generating the first surgical plan includes selecting one or more surgical tools appropriate to perform an orthopedic surgery on the first patient's bone.

18. The method of claim 17, wherein selecting said one or more surgical tools includes accessing a database to choose said one or more surgical tools from a plurality of surgical tool configurations stored therein.

19. The method of claim 11, wherein generating the first surgical plan includes:

determining whether a bone distraction is needed for the first patient's bone; and

preparing a day-by-day length adjustment schedule for each strut in a fixator to be mounted on the first patient's bone.

20. The method of claim 19, further comprising:

receiving a plurality of post-surgery X-ray images of the first patient's bone along with the fixator mounted thereon; and

revising the day-by-day length adjustment schedule based on the plurality of post-surgery X-ray images.

21. The method of claim 11, further comprising:

displaying the first surgical plan on a computer screen; and

allowing a surgeon to print one or more portions of the first surgical plan displayed on the computer screen.

22. The method of claim 11, further comprising:

creating a 3D simulation of one or more surgical procedures contained in the first surgical plan; and

displaying the 3D simulation on a computer screen accessible to a surgeon operating on the first patient's bone.

23. The method of claim 12, wherein generating the first surgical plan further includes:

determining accessibility of the osteotomy site during an actual orthopedic surgery; and

revising the first surgical plan based on the accessibility determination so as to generate a revised first surgical plan that allows a surgeon to more easily access the osteotomy site during the actual orthopedic surgery.

24. A computer-readable storage medium having stored thereon instructions, which, when executed by a processor, causes the processor to perform the following:

define a 3D (three-dimensional) template model for a patient's bone;

store a plurality of digitized 2D (two-dimensional) X-ray images of the patient's bone in a computer memory;

extract 2D fiducial geometry of the patient's bone from each of said plurality of digitized 2D X-ray images; and

deform the 3D template model using the 2D fiducial geometry of the patient's bone so as to minimize an error between contours of the patient's bone and those of the deformed 3D template model.

25. The computer-readable storage medium of claim 24, which, when executed by the processor, causes the processor to further perform the following:

read digital data associated with the deformed 3D template model of the patient's bone, wherein the digital data resides in the computer memory; and

generate a surgical plan for the patient's bone based on an analysis of the digital data associated with the deformed 3D template model.

26. A method of providing assistance in planning an orthopedic surgery comprising:

receiving from a remotely-located surgeon a plurality of 2D (two-dimensional) X-ray images of a patient's bone over a communication network;

generating a 3D (three-dimensional) simulation of one or more surgical procedures to be performed on the patient's bone, wherein the 3D simulation is generated based on data contained in the plurality of 2D X-ray images; and

sending the 3D simulation along with a surgical plan for the patient's bone to the remotely-located surgeon over the communication network.

27. The method of claim 26, further comprising at least one of the following:

charging a per-surgery fee to the remotely-located surgeon;

charging a renewable subscription fee to the remotely-located surgeon; and

charging a one-time subscription fee to the remotely-located surgeon.

28. The method of claim 26, wherein the communication network is the Internet.

29. A system for providing assistance in planning an orthopedic surgery comprising:

a target computer connected to a communication network, wherein the target computer is accessible by a surgeon to be operating on a patient's bone, and wherein the target computer is configured to transmit a plurality of digitized 2D (two-dimensional) X-ray images of the patient's bone over the communication network; and

a host computer in communication with the target computer and connected to the

communication network, wherein the host computer is configured to perform the following:

receive over the communication network the plurality of digitized 2D X-ray images of the patient's bone sent by the target computer,

generate a 3D (three-dimensional) simulation of one or more surgical procedures to be performed by the surgeon on the patient's bone, wherein the 3D simulation is generated based on data contained in the plurality of digitized 2D X-ray images, and

transmit the 3D simulation along with a surgical plan for the patient's bone to the target computer over the communication network.

30. The system of claim 29, wherein the communication network is the Internet.